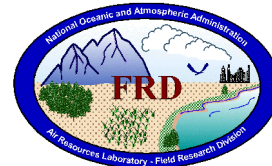




# FRD Activities Report April 2002

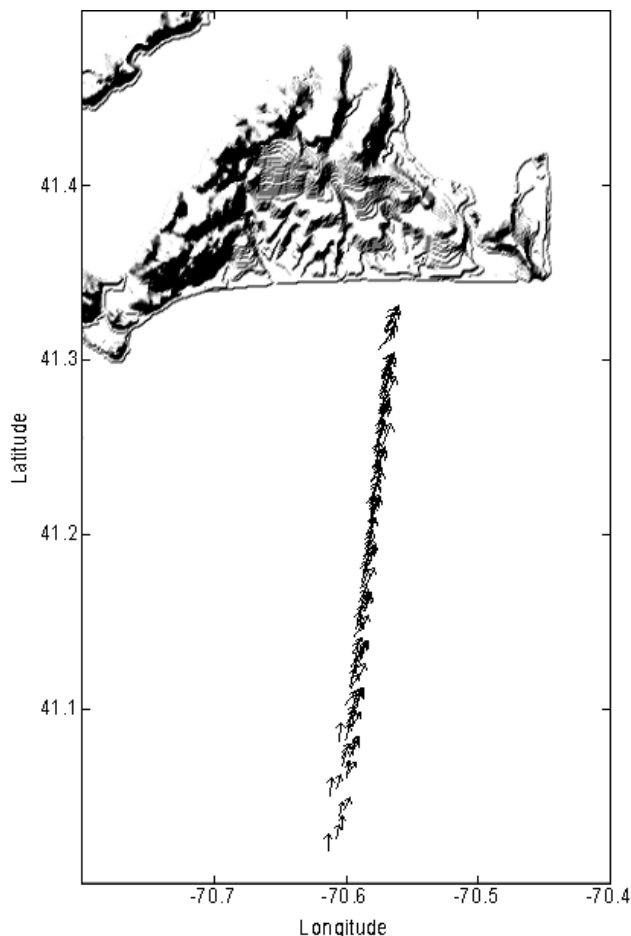


## Research Programs

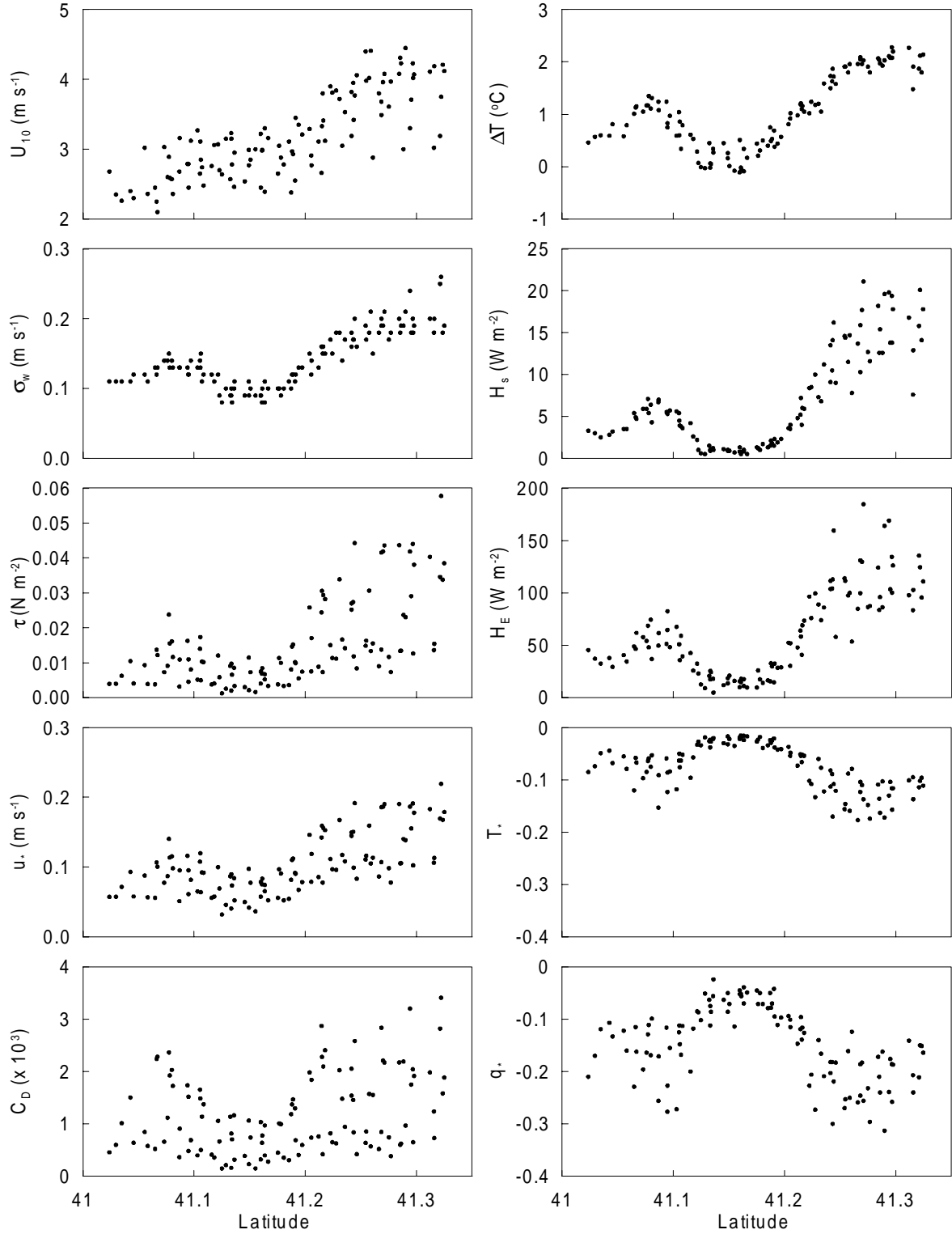
### *CBLAST-Low*

Preparations are underway for the next CBLAST-Low field study which will be conducted in August 2002. The LongEZ research aircraft will be based out of the Hyannis/Barnstable Regional Airport on Cape Cod, Massachusetts. Two additional instruments will augment the LongEZ instrument suite for this upcoming field study. A Licor 6262 gas analyzer will be used as a low-frequency baseline for the fast response CO<sub>2</sub> concentration acquired by the infrared gas analyzer (IRGA). A MicroPac spectrometer will be used to acquire ocean color in an attempt to quantify biological productivity and verify satellite-derived color estimates of the oceanic surface layer.

Meanwhile, data analysis continues on the CBLAST-Low data acquired by the LongEZ during the pilot study conducted over a three-week period in July and August 2001. On 21 July 2001 between 1300 and 1630 UTC (Flight 01), the LongEZ flew twelve north-south flux legs 10 m above the ocean surface from near the southern shoreline of Martha's Vineyard out into the Atlantic Ocean for a distance of about 30 km. Figure 1 shows 60-s (~3 km) mean wind vectors from Flight 01. Winds were about 2 m s<sup>-1</sup> from the south-southwest at the southern end of the flux legs and increased linearly to about 4.5 m s<sup>-1</sup> from the southwest near the coastline. Various mean and turbulence parameters are shown in Figure 2. These include the 10-m mean wind speed ( $U_{10}$ ), air-sea temperature difference ( $\Delta T$ ), standard deviation of the vertical wind speed ( $\sigma_w$ ), wind stress ( $\tau$ ), friction velocity ( $u_*$ ), drag coefficient ( $C_D$ ), sensible heat flux ( $H_S$ ), latent heat flux ( $H_E$ ), and temperature and humidity scaling parameters ( $T_*$  and  $q_*$ , respectively).

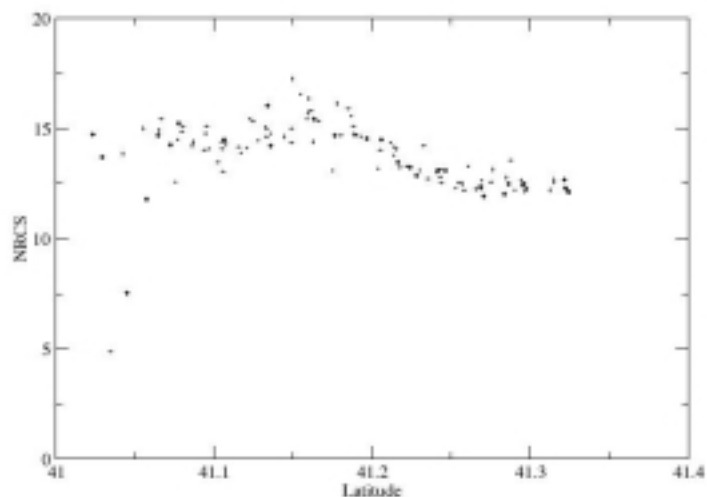


**Figure 1.** Mean wind vectors from CBLAST-Low Flight 01 (21 JUL 01).



**Figure 2.** Flight 01 turbulence parameters. Left column: 10-m wind speed ( $U_{10}$ ), standard deviation of vertical wind speed ( $\sigma_w$ ), wind stress ( $\tau$ ), friction velocity ( $u_*$ ), and drag coefficient ( $C_D$ ). Right column: Air-sea temperature difference ( $\Delta T$ ), sensible heat flux ( $H_s$ ), latent heat flux ( $H_E$ ), temperature and humidity scaling parameter ( $T^*$  and  $q^*$ ).

The air-sea temperature difference  $\Delta T$  increases from 0.5 to 1.5 °C over the first 5 km at the southern end of the flux legs with a local maxima about 25 km from the shoreline. Note a positive  $\Delta T$  represents colder air over warmer water, i.e., an unstable atmospheric boundary layer. Over the next 8 km,  $\Delta T$  decreases to about 0 °C, representing a local minima about 17 km from the shoreline.  $\Delta T$  increases from 0 °C to slightly over 2 °C from 17 km offshore to the coastline. Most of the turbulence parameters shown in Fig. 2 display a high correlation (0.92) to  $\Delta T$ . From a mechanically mixing perspective, vertical mixing ( $\sigma_w$ ) is proportional to  $\Delta T$ . The wind stress  $\tau$  is also highly correlated (0.70) to  $\Delta T$  but shows considerably more scatter near the shoreline. This is probably due to shoaling of waves in shallower waters. As expected, the friction velocity  $u_*$  is very similar to  $\tau$ . The drag coefficient  $C_D$  shows considerable scatter both at the southern and northern ends of the flux legs where the boundary layer is unstable. Conversely, much less scatter is observed over the waters where  $\Delta T$  approaches 0 °C. From a buoyantly mixing perspective, the fluxes of sensible and latent heat ( $H_s$  and  $H_E$ , respectively) are highly correlated (0.94 and 0.88, respectively) to  $\Delta T$ . As expected for a marine atmospheric boundary layer, the latent heat flux is an order of magnitude larger than the sensible heat flux. The temperature and humidity scaling parameters ( $T_*$  and  $q_*$ , respectively) are nearly zero over the waters where  $\Delta T$  approaches 0 °C and become largely negative over the waters where unstable conditions exist. Fig. 3 is a plot of the normalized radar cross section (NRCS) which is an inverse measure of the ocean's surface roughness. NRCS exhibits an inverse correlation with  $\Delta T$ . As the surface of the ocean becomes more smooth ( $\Delta T \approx 0^\circ$ ), NRCS increases. Closer to the shore, NRCS decreases as the surface roughness increases probably due to shoaling. The increase in scatter farthest from shore is likely due to the low wind speeds and hence lower surface roughness. At the lower wind speeds, the scatterometer has more difficulty registering returns from the ocean surface as there are not as many facets normal to the radar beam. (Jerry.Crescenti@noaa.gov, Tami Grimmer)



**Figure 3.** Normalized radar cross section (NRCS) for Flight01.

## URBAN 2000

Work has begun on a final report for the URBAN 2000 tracer data set. This will likely be a rather large report because of the scope of work included in the project. All 100 bag samplers were deployed as well as 6 mobile  $SF_6$  analyzers. (Kirk.Clawson@noaa.gov and staff)

## ***IMS Development***

During the past month, we have constructed one prototype IMS instrument and are building a second prototype. The first one is very crude and constructed of a length of 2 inch diameter PVC pipe with wire wrapped around the outside (a.k.a. the PVC Wonder). This was intended as a way to test electronic circuitry and experiment with ion generation. Although we really didn't expect it to work, it does detect oxygen ion peaks and has allowed us to gain valuable experience in ion gate design, ion gate driver circuitry, amplifier design, noise suppression, and collector plate operation.

The second prototype IMS is constructed of machined rings of teflon and stainless steel that are stacked together to form the IMS drift cell. The cell is assembled and waiting for an ion gate and collector plate to become operational. The ion gate was designed using testing done with the first prototype. It will be constructed using a commercially produced printed circuit board and will feature 0.6mm spacing between the wires, 0.002 inch diameter wire, and zero axial separation between the two sets of wires in the gate. This design should have less ion leakage than the commercial gates we are aware of. The circuit board for the gate is expected to be complete on May 2. After attachment of the wires, it will be included in the new IMS prototype and we should be able to make our first serious attempts at IMS measurements. (Roger.Carter@noaa.gov, Shane Beard, Debbie Lacroix)

## **Cooperative Research with INEEL**

### ***Emergency Operations Center (EOC)***

An exercise was held at the INEEL Emergency Operations Center (EOC) on April 2, 2002. Jerry Crescenti and Brad Reese represented FRD during the exercise. The drill involved an earthquake which caused damage to an INEEL facility and leakage of hazardous materials. (Jerry.Crescenti@noaa.gov, Brad Reese)

Another exercise was held at the INEEL Emergency Operations Center (EOC) on April 23, 2002. Rick Eckman and Debbie Lacroix represented FRD during this exercise. This drill also involved an earthquake which caused damage to an INEEL facility and leakage of hazardous materials. (Debbie@noaa.inel.gov, Rick Eckman)

### ***Data set for DOE Annual Exercise***

At the request of the INEEL Emergency Planning group, we have constructed a set of fictitious (or "canned") weather data to be used in the DOE annual exercise this summer. Radiological dose values calculated from the exercise scenario have been included with the data set and the emergency planning group is currently evaluating the data to see if it will meet the needs of the exercise. During the exercise, participants will be able to display the data on their workstations just as actual meteorological data would be displayed in a real emergency. (Roger.Carter@noaa.gov)

## ***INEEL Support***

The DOE-ID Interagency Agreement (IA) is finally getting attention. All that remains is for final approval by the DOE Contracting Officer Technical Representative (COTR) to approve the wording before it is sent to us for approval. The so-called safety clause, wherein FRD is controlled by the INEEL Management and Operations contractor, is unfortunately still in the IA. We are working to get that changed.

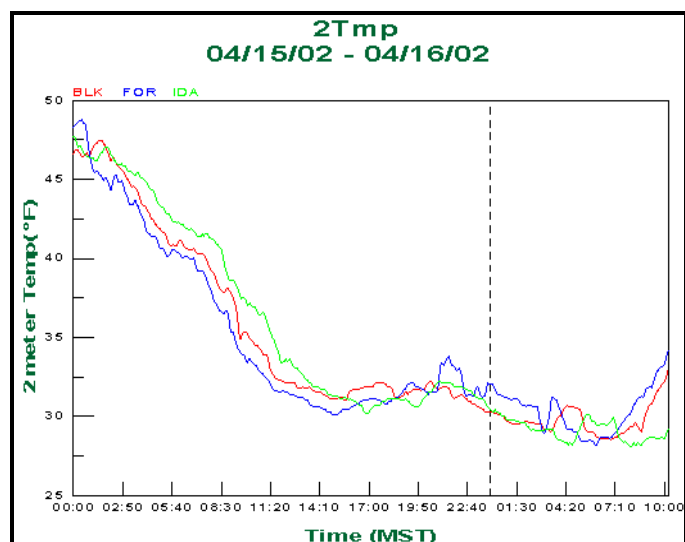
On the positive side, our COTR is pleased with every aspect of our program and this shows in our funding level. In fact, of the five INEEL monitoring groups, we are the only ones to have survived without a cut in our funding this year. It's due primarily to FRD's conscientious attention to detail which is exhibited in our safety record. At this time, our COTR is battling poor safety performances of at least 2 of those INEEL monitoring groups. She went so far as to suggest to the director of one group that he should talk with us about our safety program so he could use it as a model for his group! (Kirk.Clawson@noaa.gov and staff)

## ***Radar Profiler Repair***

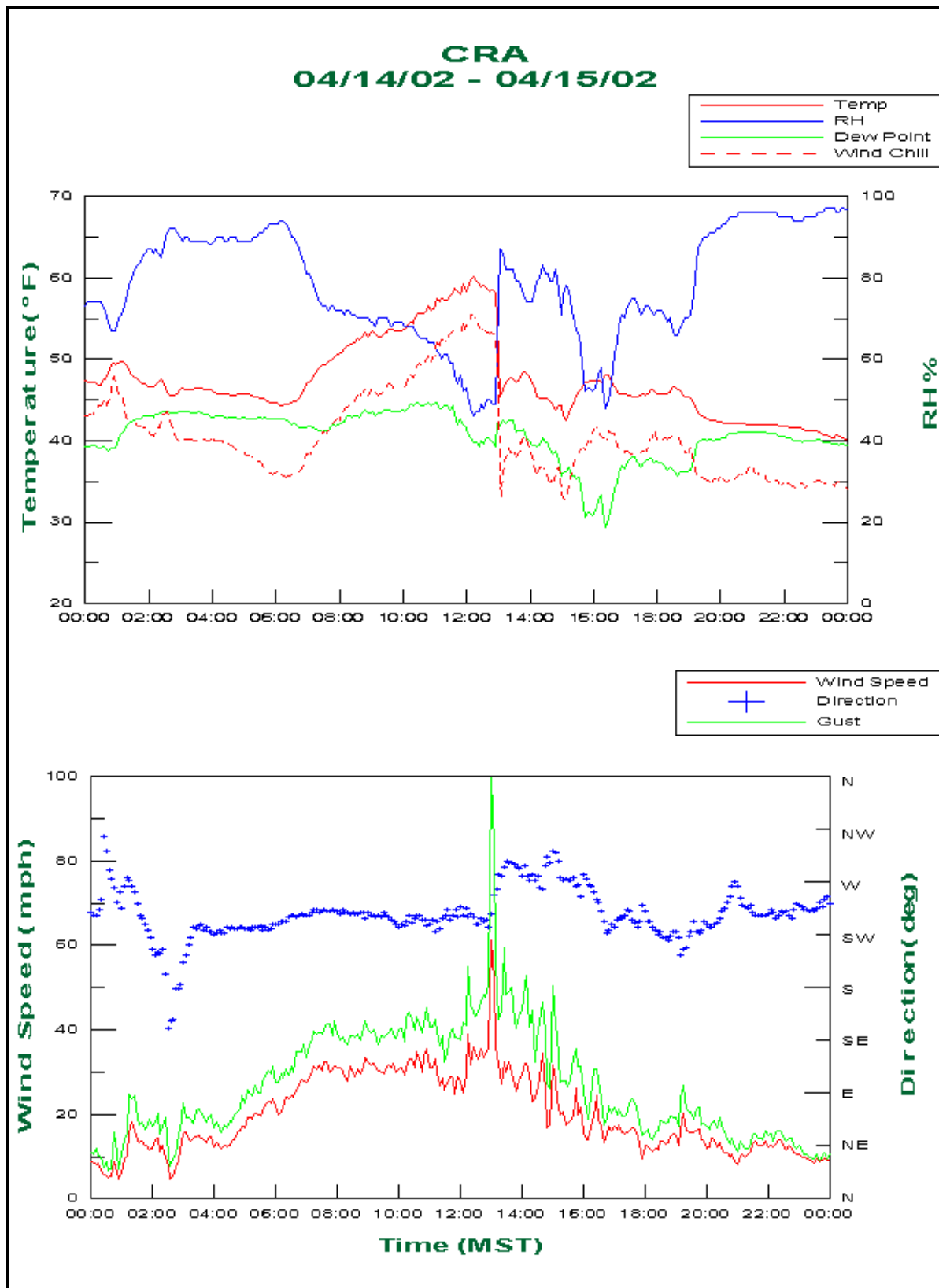
Semi-annual maintenance on the INEEL 915-MHz radar profiler revealed another burned out audio speaker in the RASS system. The speaker is being forwarded to a repair shop to have the voice coil replaced. Repair of voice coils seems to be required on a fairly regular basis. Fortunately, the profiler continues to operate reasonably well with one or two speakers out of commission, so the failures have not been a significant problem. (Roger.Carter@noaa.gov)

## ***Mesonet Displays***

A Real-time INEEL Mesonet data display has been available for some time on the NOAA FRD web site (<http://www.noaa.inel.gov>). Now, three years of archived Mesonet data and radar profiler sounding data are available on-line through the FRD web site by clicking on the Weather button at the top of the page and selecting Mesonet Data. The user is then presented with 5 different data display options. The Windfield Display button is the real-time display that has been in use for a couple of years. The remaining four options permit the user to select archived mesonet data. By selecting Tabular Data, the meteorological data for any station and any meteorological parameter for any 5-minute interval in the past three years can be displayed in a tabular format. By selecting Graphical Data, the data from up to seven stations at



**Figure 4.** Temperature for the Blackfoot, Fort Hall and Idaho Falls community monitoring stations from midnight on the 15<sup>th</sup> to 10:00 a.m. on the 16<sup>th</sup> of April

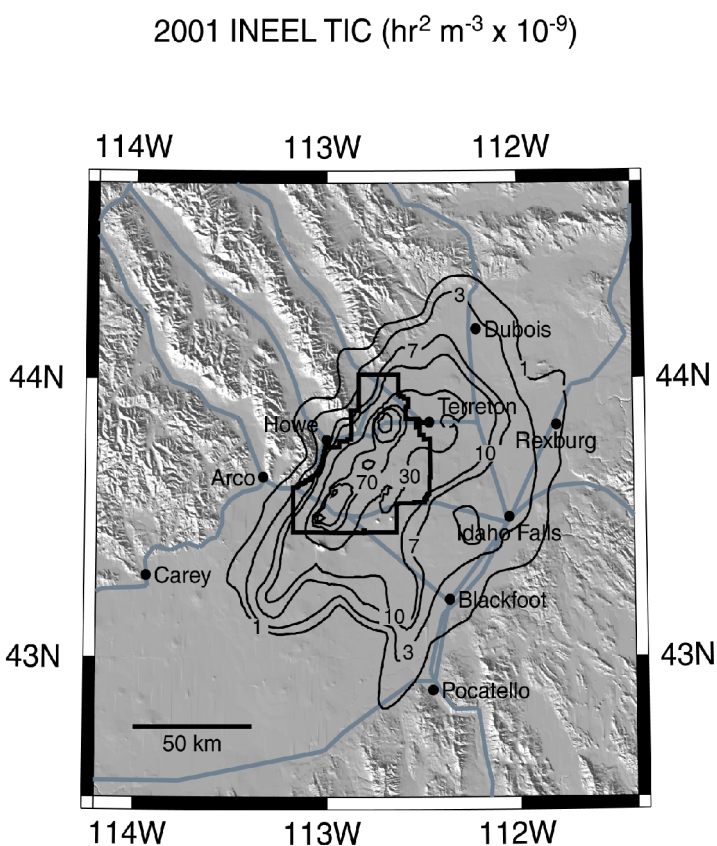


**Figure 5.** Craters of the Moon meteorogram from April 14, 2002. Note the wind gust of 99 mph and the simultaneous and abrupt changes in air temperature shortly after noon.

a time can be presented for each meteorological measurement for a time period of as little as ten minutes up to as long as seven days. Figure 4 is an example of this type of output. The graph shows the temperature for the Blackfoot, Fort Hall and Idaho Falls community monitoring stations from midnight on the 15<sup>th</sup> to 10:00 a.m. on the 16<sup>th</sup> of April. Yet another type of display is the meteogram. The user can choose to display up to 1 week of data, i.e., wind speed, wind gust, wind direction, air temperature, dew point temperature, wind chill and precipitation simultaneously for a given Mesonet station. Figure 5 is an example meteogram for Craters of the Moon, which set an all-time wind gust record on April 14. (Brad.Reese@noaa.gov)

### ***Dispersion Modeling***

Every year FRD must run a set of annual dispersion estimates for the previous calendar year. These estimates go into the INEEL Annual Site Environmental Report. Estimates for calendar year 2001 were completed in April using a version of the MDIFF puff model. The INEEL contractors who use the model output requested several modifications compared with prior years. The main one was an expansion of the model domain so that it extends at least 80 km in all directions from the INEEL facilities. This required some changes to the MDIFF source code. Figure 6 shows isopleths on the enlarged domain for TIC/q, where TIC is the total integrated concentration and q is the source strength. These TIC plots have remained fairly stable from year to year. When all is said and done, it is unlikely that the enlarged domain improved the dispersion estimates, because there are no Mesonet towers covering the new areas added to the domain. (Richard.Eckman@noaa.gov)



**Figure 6.** Isopleth map for TIC/q based upon all Mesonet data collected in 2001.

The statistical investigation of dispersion at INEEL based on 9 years of Mesonet data was largely completed in April. Efforts are now directed towards writing a draft report entitled “A Statistical Investigation of Atmospheric Dispersion at the Idaho National Engineering and Environmental Laboratory. This will be published as a NOAA Technical Memorandum. (Richard.Eckman@noaa.gov)

## **Other Activities**

### ***Proposals***

*Analysis of CO<sub>2</sub> Flux Spatial Variability over Coastal Waters* by Gennaro H. Crescenti, submitted to NOAA's Office of Global Programs, Global Carbon Cycle Element FY-2002 Program Announcement, Synthesis, Modeling, Interpretative Studies and Human Dimensions Theme.

### ***Papers***

Allwine, K. J., J. H. Shinn, G. E. Streit, K. L. Clawson, and M. Brown, 2002: Overview of URBAN 2000. *Bull. Amer. Meteor. Soc.*, **83**, 521-536.

Clawson, K. L., and G. H. Crescenti, 2002: Meteorological measurements during the URBAN 2000/VTMX field study. NOAA Technical Memorandum OAR ARL, Silver Spring, MD, submitted for ARL review.

### ***Papers Reviewed***

Pikounis, M., E. Baltas, and M. Mimikou, 2002: Temporal sampling and bucket volume effects on tipping bucket measuring accuracy. *J. Atmos. Oceanic Technol.*, reviewed by Jerry Crescenti.

### ***Travel***

Tom Watson to Washington, D. C. on April 7 for final preparations for the BRACE project. He will drive to the field site in Tampa, Florida, on April 13 where the field measurements of the project will be conducted during April and May.

Randy Johns to Crystal City, Virginia, on April 23 at the request of Department of Defense to do a presentation on Smart Balloons at the ARTEMIS Project meeting.

### ***Training***

All FRD employees received Radiation Safety Training on April 19, 2002. This training included information on regulatory requirements, radiation safety hazards, radiation safety program requirements, and emergency response procedures. Four other employees, Kirk Clawson, Debbie Lacroix, Shane Beard, and Roger Carter also received Authorized User training that provided information about the fundamentals of radiation, biological effects of radiation and personnel exposure limits. (Debbie@noaa.inel.gov).

Jerry Crescenti and Kirk Clawson attended a two-day course entitled *Management and Leadership Skills for First Time Supervisors and Managers*. The course was sponsored by Rockhurst University and was held in Idaho Falls on April 25-26, 2002.